

NATIONAL BUREAU OF STANDARDS REPORT

10 485

A PROPOSED METHOD OF GENERATING BUILDING REGULATORY STANDARDS

September 8, 1971



U.S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

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The National Bureau of Standards¹ was established by an act of Congress March 3, 1901. Today, in addition to serving as the Nation's central measurement laboratory, the Bureau is a principal focal point in the Federal Government for assuring maximum application of the physical and engineering sciences to the advancement of technology in industry and commerce. To this end the Bureau conducts research and provides central national services in four broad program areas. These are: (1) basic measurements and standards, (2) materials measurements and standards, (3) technological measurements and standards, and (4) transfer of technology.

The Bureau comprises the Institute for Basic Standards, the Institute for Materials Research, the Institute for Applied Technology, the Center for Radiation Research, the Center for Computer Sciences and Technology, and the Office for Information Programs.

THE INSTITUTE FOR BASIC STANDARDS provides the central basis within the United States of a complete and consistent system of physical measurement; coordinates that system with measurement systems of other nations; and furnishes essential services leading to accurate and uniform physical measurements throughout the Nation's scientific community, industry, and commerce. The Institute consists of an Office of Measurement Services and the following technical divisions:

Applied Mathematics—Electricity—Metrology—Mechanics—Heat—Atomic and Molecular Physics—Radio Physics²—Radio Engineering²—Time and Frequency²—Astrophysics²—Cryogenics.²

THE INSTITUTE FOR MATERIALS RESEARCH conducts materials research leading to improved methods of measurement standards, and data on the properties of well-characterized materials needed by industry, commerce, educational institutions, and Government; develops, produces, and distributes standard reference materials; relates the physical and chemical properties of materials to their behavior and their interaction with their environments; and provides advisory and research services to other Government agencies. The Institute consists of an Office of Standard Reference Materials and the following divisions:

Analytical Chemistry—Polymers—Metallurgy—Inorganic Materials—Physical Chemistry.

THE INSTITUTE FOR APPLIED TECHNOLOGY provides technical services to promote the use of available technology and to facilitate technological innovation in industry and Government; cooperates with public and private organizations in the development of technological standards, and test methodologies; and provides advisory and research services for Federal, state, and local government agencies. The Institute consists of the following technical divisions and offices:

Engineering Standards—Weights and Measures—Invention and Innovation—Vehicle Systems Research—Product Evaluation—Building Research—Instrument Shops—Measurement Engineering—Electronic Technology—Technical Analysis.

THE CENTER FOR RADIATION RESEARCH engages in research, measurement, and application of radiation to the solution of Bureau mission problems and the problems of other agencies and institutions. The Center consists of the following divisions:

Reactor Radiation—Linac Radiation—Nuclear Radiation—Applied Radiation.

THE CENTER FOR COMPUTER SCIENCES AND TECHNOLOGY conducts research and provides technical services designed to aid Government agencies in the selection, acquisition, and effective use of automatic data processing equipment; and serves as the principal focus for the development of Federal standards for automatic data processing equipment, techniques, and computer languages. The Center consists of the following offices and divisions:

Information Processing Standards—Computer Information—Computer Services—Systems Development—Information Processing Technology.

THE OFFICE FOR INFORMATION PROGRAMS promotes optimum dissemination and accessibility of scientific information generated within NBS and other agencies of the Federal government; promotes the development of the National Standard Reference Data System and a system of information analysis centers dealing with the broader aspects of the National Measurement System, and provides appropriate services to ensure that the NBS staff has optimum accessibility to the scientific information of the world. The Office consists of the following organizational units:

Office of Standard Reference Data—Clearinghouse for Federal Scientific and Technical Information³—Office of Technical Information and Publications—Library—Office of Public Information—Office of International Relations.

¹ Headquarters and Laboratories at Gaithersburg, Maryland, unless otherwise noted; mailing address Washington, D.C. 20234.
² Located at Boulder, Colorado 80302.

³ Located at 5285 Port Royal Road, Springfield, Virginia 22151.

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by

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September 8, 1971

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ABSTRACT

This report outlines a proposed method of generating building regulatory standards. The methodology, the participants in the process, and the relative roles of these participants are detailed. The method detailed in the report provides an expeditious mechanism for developing and processing building performance and specification regulatory standards.

PREFACE

This report, "A Proposed Method of Generating Building Regulatory Standards," was prepared by the Building Research Division, NBS, for the National Conference of States on Building Codes and Standards (NCSBCS). The proposal outlined in the report was presented to the NCSBCS Executive Committee at its August 27, 1971, meeting. The National Bureau of Standards in preparing the research study was guided by the Conference discussions and the requests to the Secretariat to examine how to achieve an effective and more expeditious system of developing and processing building performance and specification regulatory standards. The proposal includes a major role for the American National Standards Institute, Inc. (ANSI) in line with the suggestions made by NCSBCS.

The experience gained by the Building Research Division during the past years in developing performance criteria, working with industry, State and local officials, building officials, standards generating organizations, private and public testing organizations, and other interested parties; combined with the laboratory based research capabilities of the Building Research Division, contributed greatly to the development of the plan outlined in this report.



Building Research Division
Institute for Applied Technology
National Bureau of Standards

Judging currently accepted standards from a performance viewpoint illustrates three basic deficiencies:

- (a) They are primarily developed and written as industrial products specifications (plastic pipe standards are excellent factory quality control standards) and offer little in the way of guidance regarding the safe and useful applications of the products involved.
- (b) They do not convey to the user the reasons why the conclusions in the standards were reached; what installation practices should be applied to the product or system.
- (c) The quality of the product is raised by raising the requirements in the standard, but this is accomplished by the slow and cumbersome process of organizing "balanced" standards developing committees. Consumer representatives (who are seldom qualified industrial engineers) on such committees can insist on detail changes in product characteristics that may improve its performance but may also be extremely inefficient and uneconomical.

The application of the performance concept to standards development particularly in the building regulatory area, offers new and greater opportunities for solving these current deficiencies. If user related performance characteristics of various building functions can be succinctly described, it is possible that such functional performance requirements can become the control factor in guiding the development

of specific product or system standards for regulatory use. This is a supplementary activity and does not preclude or replace the development of traditional industrial standards. Present product or system standards (model codes) try to meet some known but unstated safety performance requirement. The product and the system standards are often developed separately by unrelated committees and, therefore, the safety level obtained in a given lot of standards is often far from uniform. A well planned and coordinated application of the performance concept to the user related performance of buildings can establish a uniform base to which regulatory product and system standards can relate on an equitable basis.

The National Bureau of Standards (NBS) has reviewed private performance systems building programs such as the work of Ezra Ehrenkrantz in California. In response to specific requests from various Federal agencies, NBS has mounted an intensive research effort aimed at gaining experience in the production of a well related set of performance requirements for various kinds of dwelling and office units. The results of some of this research effort are illustrated in the Guide Criteria developed for HUD use in purchasing and evaluating Operation Breakthrough housing systems, and in a study of performance specifications for office building done for the Public Building Service.

The experience gained by NBS clearly demonstrates the double nature of a performance based system, relative to the evaluation of buildings. One part of the system establishes the expected performance of the various aspects of buildings, the applicable test methods that uniformly help in determining when the required performance level has been achieved, and the acceptable performance limits. The other part of

this performance based system consists of minutely detailed descriptions of acceptable industrially developed solutions to these stated performance requirements. These two sides of the performance coin imply, and in fact require, a third function -- that of evaluating proposed solutions relative to stated performance requirements. The National Bureau of Standards has gained invaluable experience in all three of these related areas. The Guide Criteria are actually purchase specifications for HUD and should not be used as performance standards for regulatory purposes without a consensus review and deletion of the non-safety aspects of those items which are not normally subjected to legal regulation. This experience of developing and working with HUD Guide Criteria has indicated to NBS that a similar performance based system can be used to supplement present regulatory systems.

Present building codes and the industrial products and construction systems they regulate grew up together. They complement one another in that present codes effectively describe the current state-of-the-art relative to industry's design and manufacturing capabilities.

However, building technology is changing rapidly and we are witnessing the increased industrialized production of a wider range of complex construction components and assemblies. Designers and builders want to take advantage of these technical and economic advances and this calls for more technically difficult evaluations by code officials.

Present code systems can make good use of a uniform method for equitably evaluating these industrial innovations, one that can maintain present public safety levels while reaping other technological benefits. Occupancy based performance criteria, test methods, and

evaluation techniques can supply that needed base for innovation evaluation.

A description of a workable system for supplementing present regulatory systems that takes advantage of already completed research follows. This system recognizes that the States, who have the legal authority and responsibility for building regulatory systems, are standards users and, as such, their involvement in standards development is absolutely necessary for the ultimate, uniform acceptance of the regulatory related standards involved. The National Conference of States on Building Codes and Standards (NCSBCS), recognizing the unique importance of nationally acceptable standards to its objectives, has established a standing committee, called the Standards and Evaluation Committee (S&E).

The S&E Committee has on several occasions stated its interest in using adequate national acceptable standards that are designed around a performance based system. The Committee has specifically identified the American National Standards Institute's (ANSI) procedures as an acceptable method for producing national consensus standards. NCSBCS has requested NBS to develop a technique for State accreditation of organizations claiming competence in the field of evaluations, testing and quality assurance services. NCSBCS has also asked NBS to develop a performance evaluation system, whereby a State can accurately and equitably evaluate innovative building products and systems so reliably that interstate acceptance of single evaluations can be assured. The S&E Committee recommended, and the Conference endorsed, a request that the NBS devise a way of developing performance criteria as a component of an evaluation system and a procedure for developing

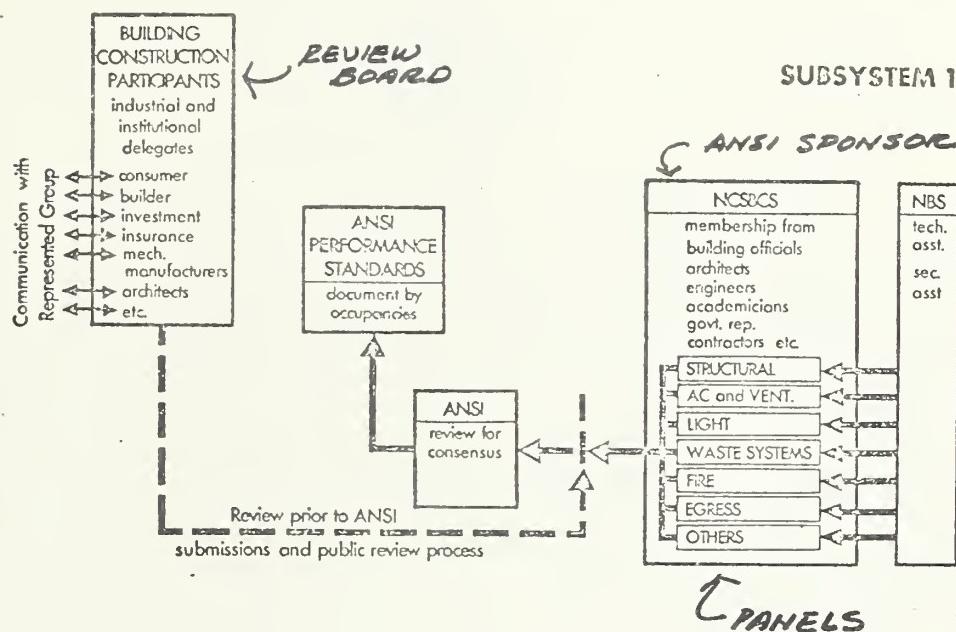
a complete set of up-to-date standards for those products and processes used in building construction.

The total proposed system emerging from the NBS study includes the use of the American National Standards Institute (ANSI) and its procedures. Other main parts of the system besides NCSBCS are the evaluation and testing organizations, the organizations of the building code officials that assemble the regulatory standards and promulgate them into a document used as a reference code, and a Review Board made up of delegates representative of all those participants in building construction including owners and users. As envisioned in this proposed system, the Review Board should be sponsored by an organization recognized nationally by the building construction community (Building Research Advisory Board of the National Research Council, Construction Action Council of the National Chamber of Commerce, Federal Agency, etc.). It is suggested that NCSBCS request ANSI to convene a group of delegates representing respective segments of the building construction community who will discuss and select an appropriate sponsor. NBS is ready to assist ANSI with this task.

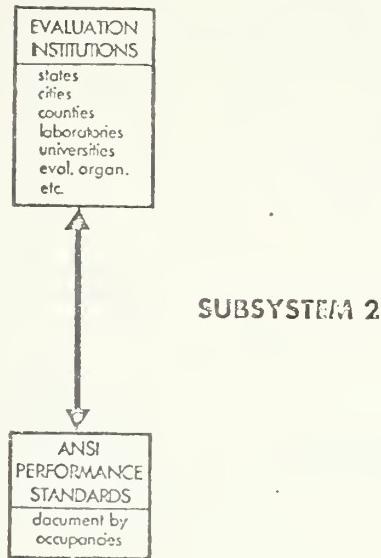
The interrelationships of these groups can be more readily visualized by use of charts which show the make-up of the various bodies involved and the relationships of each as described in the following three subsystems.

The first chart, subsystem 1, shows the National Conference of States on Building Codes and Standards as the ANSI sponsor of several closely related Performance Requirement Panels. NBS provides technical

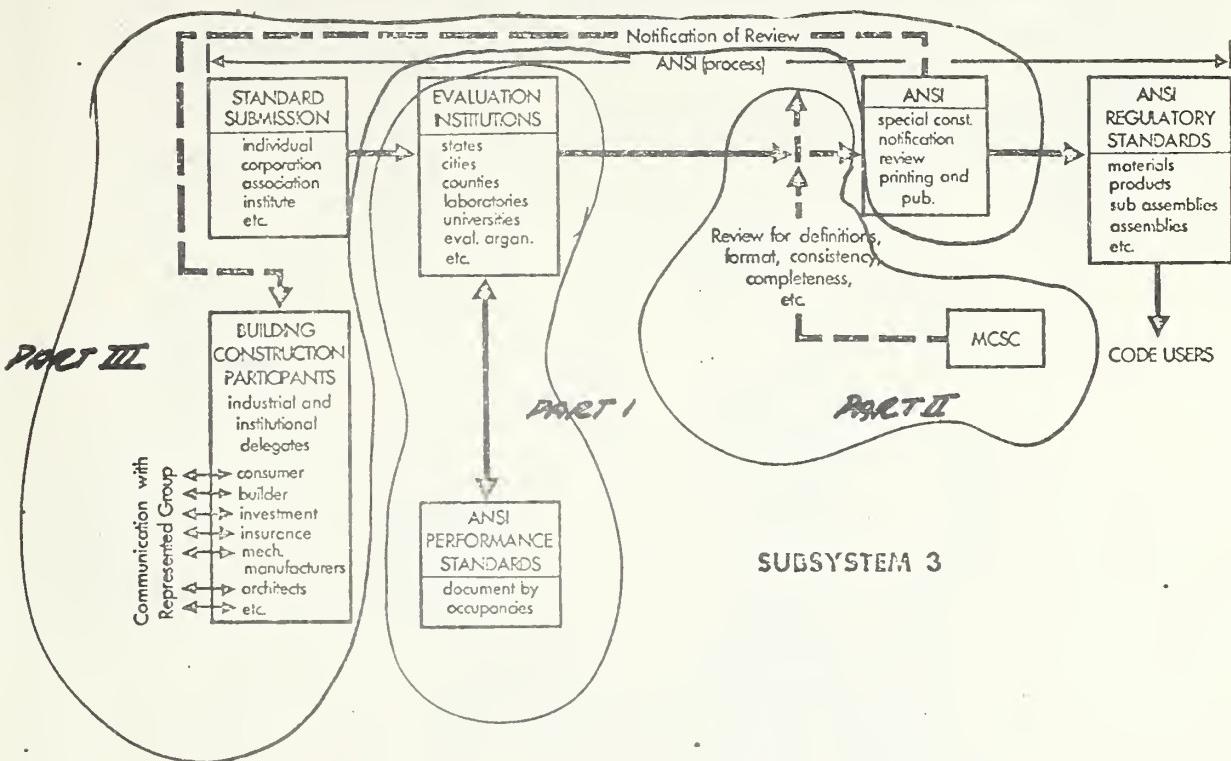
and secretarial support to each. These panels are to be made up of members from professional societies, building official organizations, the academic community, Federal agencies and contractor groups, and members of subject related ASTM test development committees. It is intended that these Panels would be so structured as to represent a national consensus of those substantially interested in the performance requirement aspects of the various subject areas involved.



The performance standards drafts developed would be submitted to the aforementioned review board whose members would be expected to communicate with their respective organizations for review and comment. These comments are to be resolved by Performance Requirement Panels and the resulting proposals sent on by NCSBCS to ANSI for consensus review and eventual recognition as American National Standards.

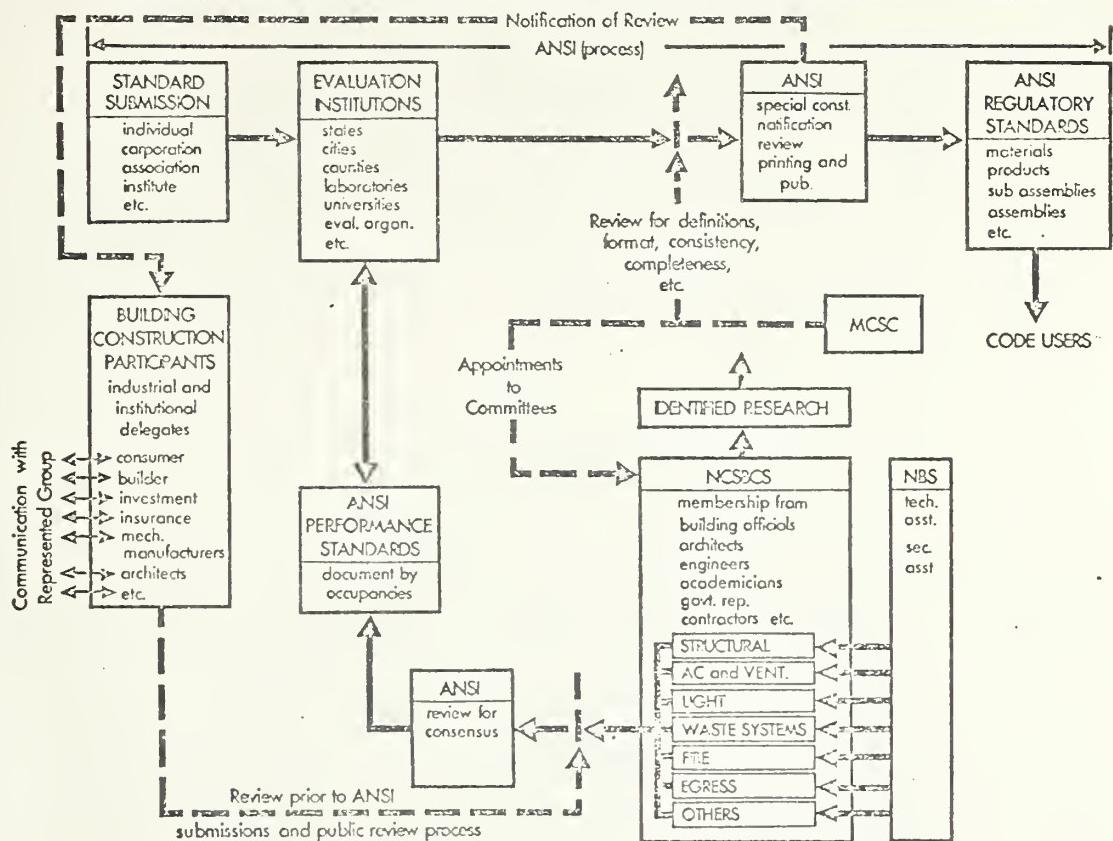


Subsystem 2 represents the use of these performance standards by recognized evaluation institutions as the control factor in producing regulatory product or systems standards that specifically satisfy the requirements developed in subsystem 1. A system for recognizing competent evaluation institutions is now under study in NBS, per request of NCSBCS. This project, called Laboratory Evaluation and Accreditation Program (LEAP), is a research study of necessary criteria and methodology of evaluating institutions (laboratories) for performance of evaluations, testing, and quality assurance responsibilities. These reports will be submitted to NCSBCS for processing as national standards with ANSI. NBS is also developing for NCSBCS an evaluation process and documentation ultimately to become an ANSI standard for use by the evaluation institutions in carrying out a regulatory evaluation for regulatory acceptance purposes.



Subsystem 3 consists of three parts. Part 1 consists of a review of the proposed regulatory standard by qualified evaluation institutions using the ANSI performance requirement standard as the control factor. Part 2 indicates a review of the proposed standard by the Model Code Standardization Council for the correct use of definitions, format, types of construction, use and occupancy classifications, etc., so that the final documents are in a form appropriate for ready reference by code users. Part 3 is the final regulatory standard review process by ANSI which specifically includes a review by the Review Board and public notification for national comment. These three parts should obtain adequate evaluation of a proposed standard as well as necessary checks and balances between each of the participating organizations. The resulting regulatory standards would become the "plug-in" standards which NCSBCS has identified as needed for any nationally accepted system.

PERFORMANCE AND REGULATORY STANDARDS GENERATION PROCESS



In summation, the combination of these three subsystems provides a way of speedily producing regulatory standards and gaining acceptance of the products or systems they define. The system also optimizes the knowledge and expertise of our country's human resources concerned with building construction and use. Where older standards had to be produced by balanced committees in order to take care of the safety performance of the products involved, this new system with its performance control factor permits standard submitters to be individuals, corporations, organizations, etc. The resultant regulatory standards could more rapidly be produced and maintained. The system described does place a large burden on the building construction community to see that the liaison delegates on the Review Board do in fact make an effort to reflect the views of their respective organization groups. Such organizations and groups will be expected to maintain close surveillance of their delegates in this activity area.

It is hoped that this proposed method will be a basis for a discussion by all building construction participants in forging an effective and more expeditious mechanism for the development of performance and specification building regulatory standards.

